NEWS FLUID LOGIC CONTROL SYSTEMS

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EMERGENCE OF NEW CONTROL SYSTEM TECHNOLOGY

A new type of pneumatic control system which utilizes components and phenomina unknown during the considerable history of pneumatic control has just passed its first extensive industrial trials. Extensive application of this type of system to control problems in all industries is anticipated. While electronics has been the "modern" way to build industrial control systems during the last three decades, no-moving-parts or "solid state pneumatic" systems now occupy the position of "most advanced" and promise much lower cost, more reliable controls than ever available by older electrical, pneumatic or hydraulic techniques.

Over 100 companies are estimated to have research activities in the new field, variously called the "fluid logic" or "fluid amplification" field. These companies are engaged in basic and application studies of a variety (five or six) fluid dynamic devices which are, in effect, no-moving-parts valves and at the same time amplifiers. It is possible, in theory and in some cases in reality, to build complex computer-like control systems using these elements in somewhat the same way that transistors are used in electronic computers. Of course, these fluid dynamic devices control the flow of small quantities of low-pressure air rather than electrons as is the case in electronic devices.

The first complex industrial control system to use one of these new "fluid logic" elements was built using "turbulence amplifiers", an invention of Mr. Raymond N. Auger, President of Raymond N. Auger & Co., 456 Riverside Drive, N.Y., N.Y.. In a paper presented at the Systems Engineering Conference held in N.Y., Mr. Auger stated that over one year ago a complex counter-controller using over 120 turbulence amplifiers was installed at the Speidel Corp., leading watchband

manufacturer in Providence, R.I., and that the unit has performed so well that a second similar systems has been recently installed. These two systems are the only known examples of a complex fluid logic control system in actual industrial use. The Soviets had indicated that they had systems containing "thousands of elements" in use, but have not indicated where or with what type of fluid logic element. Also, a number of government-financed studies are now under way to apply fluid logic controls to jet engines and other applications, but these have not left the early research stages as yet.

Mr. Auger's paper described some of the basic principles being employed in the construction of turbulence amplifier fluid logic systems, with special emphasis on the utility of long laminar streams. These are air streams the size of an automatic pencil lead - thirty thousandths of an inch in diameter - which can be projected distances of up to two inches without losing their coherent shape - that is, without becoming turbulent and fanning out in a cone as most projected air streams do. Long laminar air streams have been considered inherently unstable, but Mr. Auger has proven that properly formed they are stable enough to be used in the most sever industrial environments for a variety of pneumatic contactless-sensing, signal amplification and switching functions. Using these streams as a means of generating control system input signals, it is then possible to use other laminar streams within a special structure which constitutes a "turbulence amplifier" and which can perform the logical NOR function. Thanks to the fact that the NOR function is a basic logical building block from which it is possible to devise memory, OR, AND, NOT logic functions as well as counting, adding or other arithmetic circuits, the turbulence amplifier need be the only device employed in the construction of complex computer-like controls. Laminar streams can be used to detect the holes in perforated cards, detect rapidly rotating cams or other machine parts, and even detect motion of an object partially interrupting such a stream by as little as fifty millionths of an inch.